

Gasless Single Incision Endoscopic Thyroidectomy

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ABSTRACT

Background: Endoscopic thyroidectomy making the scar outside the neck area has a cosmetic appeal for patients. Based on an anterior chest wall approach combined with the gasless technique, we developed a novel method for gasless endoscopic thyroidectomy with a single incision.

Materials and Methods: From March 2009 to November 2010, 48 patients with benign thyroid nodules underwent thyroidectomy with the gasless single-incision endoscopic surgery technique via the anterior chest wall approach. A 3-cm long skin incision parallel to the clavicle was made on the anterior chest wall on the side of the lesion. The platysma flap was lifted up to maintain working space from the incision to the thyroid cartilage. Dissection of the thyroid was begun from the inferior pole of the thyroid. The line of resection was selected to preserve recurrent laryngeal nerve and parathyroids. A 5-mm drainage tube was inserted into the lower portion of the operative space through the incision after the thyroid gland and the lesion were resected using the Harmonic scalpel.

Results: The overall operating time was 126 minutes (range, 90 to 210), 138 minutes (range, 80 to 160) in first 24 cases; and 112 minutes in the second 24 patients ($P < .05$). Three cases were converted to the conventional procedure: 2 because of a malignancy diagnosed on frozen section, and one due to uncontrolled bleeding from the middle thyroid vein. Another malignancy diagnosed on final pathological examination was treated with additional surgery to complete the thyroidectomy by using the conventional open method. There were 2 cases of post-operative complications: transient hoarseness and hematoma. No wound infection occurred in our series. The scar

was well hidden beneath the clothes, and the patients were satisfied with the cosmetic result of the surgery.

Conclusions: Advantages of the chest wall approach combined with the gasless technique have made single-incision endoscopic thyroidectomy more feasible and practicable.

Key Words: Endoscopic surgery, Thyroidectomy, Gasless, Single-incision surgery.

INTRODUCTION

Thyroidectomy is one of the most common procedures performed in the field of surgery. Conventional thyroidectomy usually makes a 6-cm long incision on the anterior neck, which deters patients from undergoing surgery, especially young women. Endoscopic thyroidectomy making the scar outside the neck area has a cosmetic appeal for patients. Since endoscopic thyroidectomy was first reported by Husher in 1997,¹ it has been increasingly accepted by surgeons and patients worldwide. Various endoscopic thyroidectomy methods, classified as either a surgical approach or establishment of working space, have been introduced for the purpose of cosmesis.²⁻⁶

The anterior chest wall approach is attractive to surgeons and patients, for this method not only makes the incision away from the front of the neck but also makes the procedure more feasible compared to other endoscopic thyroidectomy approaches.^{5,7} Another advantage of the chest wall approach for endoscopic thyroidectomy is that endoscopic thyroidectomy could be accomplished via a single incision without gas insufflation, thus avoiding the gas insufflation-related complications.⁸⁻¹¹ Based on the anterior chest wall approach combined with the gasless technique, we developed a novel method for gasless endoscopic thyroidectomy with a single incision. Herein, we report our preliminary experience of gasless single-incision endoscopic thyroidectomy via a chest wall approach.

MATERIALS AND METHODS

From March 2009 to November 2010, 48 patients with benign thyroid nodules, diagnosed on the fine needle

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aspiration biopsy, underwent thyroidectomy with the gasless single-incision endoscopic surgery technique via the anterior chest wall approach. The preoperative diagnoses were follicle thyroid adenoma in 40 patients, nodules in 6 patients, papillary in 2 patients. Of 48 patients, with median age of 42 years (range, 18 to 56), 46 patients were female and 2 were male. The inclusion criteria were as follows: single nodule, size of nodule <3cm in diameter, no previous anterior neck surgery, no history of neck radiation, absence of malignancy. Laryngoscopy was performed in the preoperative and postoperative settings to verify vocal fold motion.

The abdominal wall-lifting device (Mizuho Company, Japan) was used as the skin flap-lifting device for maintaining the working space. The Harmonic scalpel was used to dissect and divide the thyroid gland and its surrounding connective tissues. The instruments for gasless surgery (Mizuho Company, Japan) were introduced for dissection and ligation.

All patients were fully informed about the characteristics of this procedure and its advantages over open or multi-incision endoscopic thyroidectomy. Written consents were obtained from all the participants or their family members. The ethics committee of our institution approved this study.

At the time of neck nerve block anesthesia, prophylactic antibiotics were administered to prevent wound infection. With the neck nerve block anesthesia, the patient was in a supine position with a pillow beneath the shoulder extending the neck slightly. The surgeon stood on the side of the lesion and the assistant stood on the right side to the surgeon.

A 3-cm long skin incision parallel to the clavicle was made on the anterior chest wall 2 finger-breadth widths below the inferior border of the clavicle on the side of the lesion. A long hemostat or dissecting stick was inserted through this incision subcutaneously above the pectoralis major muscle, advancing upward towards the subplatysmal plane under endoscopic vision (**Figure 1**). Dissection between the subplatysmal and strap muscle advanced upwardly and medially from the incision to the thyroid cartilage. The lifting device was installed to lift up the flap of the platysma, and then working space was created from the anterior chest wall to the thyroid cartilage level (**Figure 2**). Ipsilateral strap muscles were split longitudinally and then divided horizontally to improve surgical access, and to allow the thyroid to come into view.

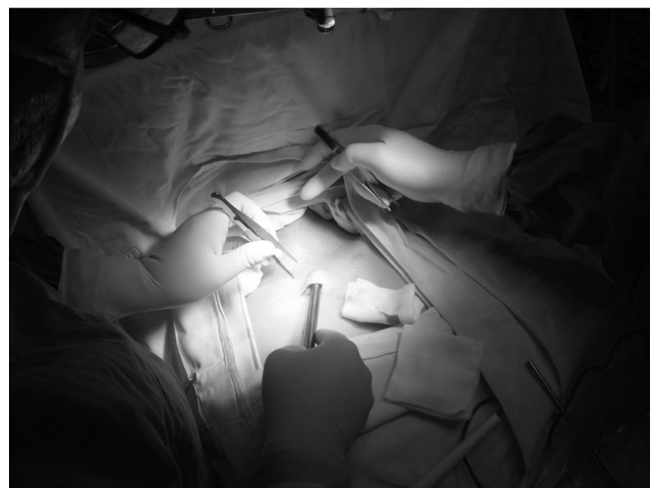


Figure 1. Dissecting stick was inserted through skin incision subcutaneously above the pectoralis major muscle advancing upwardly towards the subplatysmal plane.



Figure 2. The lifting device was installed to lift up the platysma flap, and then the working space was created from the anterior chest wall to the thyroid cartilage level.

The dissection of the thyroid was begun from the inferior pole of the thyroid. Once the inferior thyroid vessels were identified and isolated, the vessels were ligated by thread (**Figure 3 and 4**) and then divided by Harmonic scalpel, or directly divided by Harmonic scalpel close to the thyroid gland. The medial thyroid vein was treated in the same way. Then, the thyroid gland was retracted medially and upwardly, and dissection proceeded to the posterior and lateral aspects of the gland. The line of resection was selected to preserve the recurrent laryngeal nerve and parathyroids. Subsequently, the subtotal thyroid gland to-

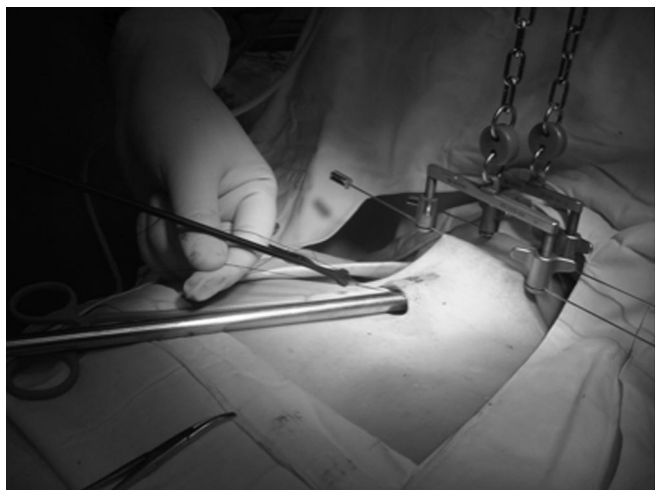


Figure 3. A ligator was used to ligate the vessels using thread.

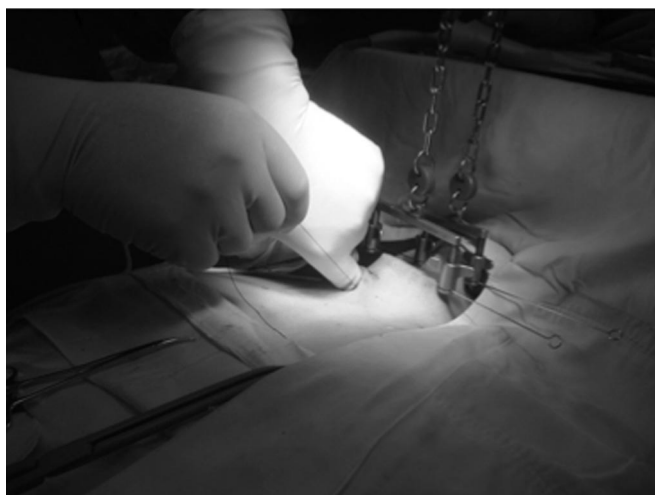


Figure 4. The vessels were ligated by thread with the finger.

gether with the lesion was excised with the Harmonic scalpel, and the recurrent laryngeal nerve and parathyroid glands were left intact.

The resected specimen was retrieved through the skin incision on the anterior chest wall (**Figure 5**). After completion of homeostasis, the strap muscles were approximated with absorbable sutures. A 5-mm drainage tube was inserted through the incision at the lower portion of the operative space (**Figure 6**). Finally, the incision was closed with sutures. The drainage tube was removed on day 2 postoperatively.

RESULTS

Frozen section revealed 2 cases of malignancy, which were converted to the conventional procedure. Another



Figure 5. The resected specimen was retrieved through the skin incision on the anterior chest wall.



Figure 6. Drainage tube was inserted through the incision.

malignancy diagnosed on final pathological examination received an additional operation to complete the thyroidectomy using a conventional open method. The surgical margins were negative in every case.

The overall operating time was 126 minutes (range, 90 to 210): 138 minutes (range, 80 to 160) in the first 24 cases and 112 minutes in the second 24 patients. The difference in operating time between the 2 groups was significant (Student *t* test, $P < .05$).

Three cases were converted to the conventional procedure: 2 because of malignancy and one due to uncontrolled bleeding from the middle thyroid vein in the first group. There were 2 cases of postoperative complications

in the first group: transient hoarseness in one patient, and hematoma in another. No wound infection occurred in our series. The scar was well hidden beneath the clothing of the patients, and all patients were satisfied with the cosmetic results of the surgery.

DISCUSSION

Since Huscher and his colleagues¹ first described the complete endoscopic thyroidectomy with constant CO₂ gas insufflations in 1997, minimally invasive surgery using endoscopic vision has been widely used for the treatment of thyroid diseases for cosmetic purposes. During the past decade, several approaches to the thyroid have been introduced, including the cervical approach, the transaxillary approach, and the breast or anterior chest wall approach with the development of laparoscopic surgical techniques and endoscopic instruments.²⁻⁵

The cervical approach utilizes small incisions in the neck, thus making it cosmetically unacceptable.² Though the approach via an axillary incision gained best cosmetic results, the relatively long route to the operative working space from the skin incision (axilla) made this approach inconvenient for the surgeons.^{4,5} Therefore, the modified method by making an incision on the anterior chest wall was developed.^{5,7} The surgeon was able to examine the thyroid anatomy by palpation or use of nonendolaparoscopic instruments to dissect or tie through the incision because of the short distance.

The gasless endoscopic thyroidectomy provides a consistent working space without collapse during suction for bleeding or smoke clearance. The gasless endoscopic method has no risk of complications, such as hypercapnia, respiratory acidosis, tachycardia, subcutaneous emphysema, and air embolism.⁸⁻¹¹ Another advantage of this technique is that three instruments could be simultaneously inserted through the incision (**Figure 7**), which facilitates the single incision endoscopic thyroidectomy.

There are some reports about permanent recurrent laryngeal nerve injuries caused by the collateral energy of the Harmonic scalpel.^{12,13} Based on those findings, some surgeons have suggested that the Harmonic scalpel tip should be placed 2mm away from the nerve, the tip should not touch the nerve just after action, and the surgeon should not use the instrument for over 20 seconds at one time.^{14,15} One patient experienced transient hoarseness as a postoperative complication in our



Figure 7. Dissecting and dividing by Harmonic scalpel. Three instruments were simultaneously inserted through the incision.

series, and the patient recovered 2 months after the operation.

From our experience, the resecting line of the thyroid gland plays an important role in preventing injury to the laryngeal nerve and ipsilateral parathyroid. Preserving the posterior capsule of the gland is crucial for keeping the recurrent laryngeal nerve and parathyroids intact. In our surgical technique, we utilize advantages from both the gasless method and the transchest approach. Two procedures were converted to open complete thyroidectomy for diagnosis of cancer on frozen section and one to an open procedure because of uncontrolled bleeding. The operative time declined significantly as the surgeon gained experience with the technique. Overall, our experience demonstrates that this procedure can be easily and safely transferred to experienced thyroid surgeons after a short learning period.

We confined our study to the benign thyroid nodule, though some authors have advocated that endoscopic thyroidectomy could be applied to low-grade thyroid carcinomas.^{6,16} If frozen section or definitive histology revealed malignancy that necessitated complete thyroidectomy, the operation should be performed via a conventional cervicotomy. Preserving the posterior surface of the thyroid played an important role in leaving the laryngeal nerve and parathyroid intact without tracing the course of the nerve. Selective criteria for endoscopic thyroidectomy remain controversial, but some contraindications are common to all these techniques: larger goiters, invasive malignant tumors, previous cervical operations, and history of neck irradiation.^{17,18} We caution that careful patient selection and the experience

of the surgeon remain critical to ensuring optimal patient outcomes with gasless single-incision endoscopic thyroidectomy.

CONCLUSION

In this study, the only postoperative complication was one case of transient recurrent laryngeal nerve palsy. The ability to identify and preserve the recurrent laryngeal nerve during endoscopic thyroidectomy had subsequently helped prevent transient hoarseness. Patients were satisfied with the surgery, because the scar in the chest wall was hidden by the patient's clothing and was not routinely visible in our Chinese patients.

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